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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003904527 for a patent by CTECH EQUIPMENT PTY. LTD as filed on 22 August 2003.

I further certify that the above application is now proceeding in the name of CTECH CLOSURES PTY LTD pursuant to the provisions of Section 113 of the Patents Act 1990.

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Twelfth day of August 2004

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**IMPROVEMENTS RELATING TO A TAMPER EVIDENT RING WITH ENGAGEMENT MEANS FOR A CONTAINER CLOSURE AND CONTAINER NECK HAVING CORRESPONDING ENGAGEMENT MEANS.**

This invention relates to a tamper evident ring for a container closure and a container neck. In particular it relates to a ring which if required can be retained on a container neck when the container closure has been removed.

A known design of tamper evident ring includes a plurality of frangible connections or bridges initially joining the ring to the container closure, and a plurality of solid radial ramp projections or protrusions to engage behind an annular tamper bead on the container neck. When the closure is removed for the first time, the projections engage the annular tamper bead to retain the ring on the neck, thus causing the frangible bridges between the ring and the closure to become severed. The ramp shape of the projections is intended to allow the ring -to be fitted easily over the tamper bead, but not easily removed.

However, a problem with this design is achieving reliability in use. Typically, this sort of ring might be about 80% reliable. If the projections are too small, the ring will be not retained securely on the neck, and it might remain intact with, or at least partly intact with, the closure when the closure is removed for the first time. Besides it being inconvenient for a user to have to separate the ring from the closure manually once the closure has been removed, this also means that the ring cannot give a guaranteed tamper-proof indication.

However if the projections are large to ensure that the ring will be retained reliably on the neck, it can then be difficult to fit the ring initially on the neck without risking damage to some of the frangible bridges.

Prior art (AU 701668) teaches us the use of a second means of engagement between the protrusions on the annular tamper ring on the closure and protrusions on the neck of the container (i.e. neck protrusions other than the tamper bead on the neck of the container) such that this second means of engagement between the tamper ring and the container prevents unscrewing movement of the tamper ring greater than one half turn of rotation whereupon the said secondary engagement means becomes effective and further rotation to remove the closure causes the severing of the frangible bridges between the annular tamper ring and the skirt of the cap.

With the majority of sealing methods the interaction between the closure means and the container neck occurs over a very small axial distance such that one half turn of the closure in the direction of removal, would remove the sealing means from juxtaposition with the container neck thereby allowing atmosphere and potential contaminants to enter into the container even though the tamper ring on the closure has not been broken.

There is also the need for either designing the frangible bridges with a cross section to impart sufficient strength to withstand the rigours of cap sorters and

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application onto the container but yet be sufficiently frangible to allow removal by persons of limited strength in hands and or wrists.

The present invention has been devised with the above problems in mind, and with the particular aim of providing an improved design both of tamper evident ring and co-operating features on the container neck.

Examples of non limiting aspects the invention are as follows provides a closure means having a tamper evident ring, a corresponding container neck for a container closure assembly consisting:

a container neck with an annular tamper bead which may be continuous or segmented and having container neck engagement means on it or depending from it or commencing above or below it consisting at least one protrusion or recess or a combination of protrusions and recesses. Such container neck engagement means being ramped or shaped or tapered to minimise friction or resistance or engagement with the closure means on application of the said closure means and also shaped so as to present a surface to engage with a corresponding surface on the tamper ring on the closure means and as referred to in the following examples but not limiting the scope of the invention:-

a container neck with at least one protrusion ramped or tapered in such direction to minimise interference between the neck and the closure during application of the closure but shaped as to present an angled surface to engage with a corresponding angled surface on the annular tamper ring on the closure. The container neck having a retention bead in the vicinity of the lower end of the protrusion angled to co-operate with a corresponding retention means on the annular tamper ring on the closure such that rotation motion to remove the closure causes engagement of the co-operating angled surface or surfaces on the neck of the container and the tamper ring on the closure such that further unscrewing movement creates both lateral and axial stress on the frangible connections between the annular tamper ring and the skirt causing separation of the tamper ring from the closure.

The number of the protrusions or angled ramps on the container may be less than or equal to or more than the number of corresponding openings or protrusions on the closure tamper ring. The positioning and numbers of the protrusions or angled ramps on the container in relation to the corresponding openings or protrusions on the closure tamper ring may include the notion of sequential engagement between the protrusions or angled ramps on the container and the corresponding openings or protrusions on the closure tamper ring such that the frangible bridges tend to be or are severed sequentially so as to minimise the force necessary to sever the frangible connections.

The orientation of the container neck engagement means i.e. protrusions or angled ramps or recesses may be such that the angle of the surfaces designed to engage with corresponding engagement means on the closure:

- 1) in reference to the normal orientation of the container i.e. vertical may be in the range from

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- a) vertical which may if the corresponding engagement surface on the tamper ring is also vertical or angled less than vertical in the direction of removal rotation engage with and prevent further movement of the tamper ring thereby breaking the the frangible bridges
  - b) to vertical less 89 degrees thereby forcing the corresponding engaging surface on the tamper ring to move downwards and sever the frangible bridges.
- 2) in reference to the wall of the container neck may be such that the angle of the engagement surfaces is in the range from 90 degrees to about 5 degrees such that an angle less than 90 degrees refers to the concept of presenting a tooth like shape to more positively engage with the tamper ring engagement means and avoid the possibility that the engaging surfaces may jump past or over each other.

The configuration of the protrusions or angled ramps may be such that they may also be shaped in such a way or of such dimension as to by engagement by some means with a device on the closure tamper ring thereby facilitate a retention means to retain the tamper evident ring on the neck of the container. However, there is a desirable benefit to the recycling process if the container is not burdened with a tamper ring of different material as is the case with most closures in use today.

In another non limiting embodiment the tamper bead has container neck engagement means consisting of axial protrusions and or recesses which are ramped or shaped so as to present minimal interference with the closure means during application of the closure but are also shaped and or angled to engage with corresponding tamper ring engagement means upon removal of the said closure means.

The tamper ring engagement means in one embodiment consists of one or more openings in the closure tamper ring which may also be openings bounded on 3 sides by the tamper ring and the 4<sup>th</sup> side by the lower edge of the skirt of the closure. The leading edge of the said openings being angled between vertical and horizontal and preferably in the range vertical to vertical plus 85 degrees and or shaped such that upon rotation of the closure in the direction of removal the angled leading edge of the said openings in the closure tamper ring engage with the said container neck engagement preventing further removal rotation of the tamper ring whereby further removal rotation of the closure causes the said frangible bridges to incur horizontal stress such that they break thus separating the tamper ring from the closure thereby evidencing that the container has been opened

The closure may have a reduced number of bridges in this instance and as such may usefully incorporate such known improvements being co operating projections in pairs where one of the pair is attached to the skirt of the closure and the other to the tamper ring such that these projections are shaped to engage and prevent rotational movement between the skirt of the closure and the tamper ring when the closure is being applied to the container thereby reducing stress on the frangible bridges and shaped to not engage or in at least one embodiment to engage ramped surfaces that cause the skirt and tamper ring to move apart thus promoting the fracturing of frangible bridges.

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Indeed in another non limiting embodiment of a closure means where it is not desired to retain the tamper ring on the container it is possible to eliminate any tamper ring retention means on the closure and or container.

The tamper ring engagement means in another embodiment consists of one or more openings in the closure tamper ring which may also be openings bounded on 3 sides by the tamper ring and the 4<sup>th</sup> side by the skirt of the closure. The leading edge of the said openings being oriented from vertical to greater than horizontal and preferably in the range vertical to vertical minus 85 degrees and or shaped such that upon rotation of the closure in the direction of removal the angled leading edge of the said openings in the closure tamper ring engage with the said container neck engagement means and further removal rotation of the closure causes the angled face of the said opening to move downwards causing the said frangible bridges to incur both vertical and horizontal stress such that they break thus separating the tamper ring from the closure thereby evidencing that the container has been opened

The said container neck engagement means protrusions and or recesses or both either separate or adjacent on or in the tamper bead on the container may also be advantageously angled and or shaped and or located to co-operate most effectively with the tamper ring engagement means on the closure tamper ring to produce vertical and or horizontal to sever the frangible bridges between the tamper band and the closure skirt

**Closures consisting of :**

- a) a top disc portion which may exhibit various sealing means on the inside thereby engaging one or more of the inside of the neck, the uppermost portion of the neck and the outside of the container neck or have provision for insertion of various liner materials as a sealing means and
- b) a depending skirt with internal thread or thread sections corresponding with the threaded container neck and
- c) an annular tamper evident ring frangibly depending from the skirt
  - i) with one or more protrusions so ramped or shaped as to present less resistance upon application of the closure and shaped so that upon unscrewing movement engagement occurs with the underside of the tamper bead on the container neck thus preventing removal of the tamper band and or
  - ii) one or more openings or ramped protrusions or combination thereof which are ramped or shaped so that upon application they minimise resistance thereby facilitating application without damaging the frangible connections between the tamper band and the cap skirt and which upon unscrewing of the cap will present a least one surface to engage one or more of the protrusions sequentially or otherwise on the neck of the container and upon further unscrewing movement either the respective angles of the engaged surfaces
  - iii) translate the horizontal unscrewing movement into an axial movement which promotes fracture of the frangible bridges and separation of the tamper ring from the closure skirt or

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- iv) prevent further movement of the tamper ring which causes further unscrewing movement to fracture of the frangible bridges and separate the tamper ring from the closure skirt

The number of openings or protrusions on the closure tamper ring may be less than or equal to or more than the protrusions or angled ramps on the container neck. The positioning and numbers of the openings or protrusions on the closure tamper ring in relation to the corresponding protrusions or angled ramps on the container neck may in one no limiting embodiment of this invention include the notion of sequential engagement between the protrusions or angled ramps on the container and the corresponding openings or protrusions on the closure tamper ring such that the frangible connections tend to be or are severed sequentially so as to minimise the force necessary to sever the frangible connections.

The present invention also extends to an alternate system whereby the concept of protrusions engaging protrusions may be in at least one instance replaced with channels or recesses co-operating with protrusions.

In another non-limiting embodiment of present invention also extends to removal of the tamper bead retaining ring located above the angled protrusions on the neck of the container and if desirable the addition/location of a retaining ring below the angled protrusions on the neck of the container so as to retain the tamper ring on the container as evidence of opening or tampering

In an alternate non limiting embodiment the present invention extends to the protrusions on the tamper ring of the closure being not angled so that the face meets a correspondingly angled face but instead being vertical. That is the ramped protrusion on the neck of the container is not vertical but the engagement face on the corresponding protrusion on the closure tamper ring is vertical. The reverse of this embodiment is also represents this concept

In an alternate non limiting embodiment of the invention the engagement face of the protrusion on the tamper ring is shaped so as to create an angle of less than 90 degrees to the wall of the tamper ring. This angled concept may also apply to protrusions or ramped angle protrusions on the neck of the container thus ensuring a more effective engagement means.

The present invention also extends in a non limiting manner to any one or more of the foregoing aspects combined with one or more of the following:-

various child resistant features one of which may be of the type whereby it is necessary to exert downward force either on the top of the closure or on the top of an over-cap which fits over the top of the closure, such that the downward force overcomes resistance thereby allowing engagement means between the over-cap and the closure to enable removal rotation of the closure to operate the tamper evident feature and remove the closure from the neck of the container.

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The concept of moulding the closure from more than one type of material. For example it would assist recycling if the closure tamper ring was moulded in the same material as the container.

Various dispensing means such as, but not limited to, a flexible membrane with cruciform or other pattern slits or openings to thereby permit the dispensing of container contents or a pump action dispenser or a push/pull valve closing/ opening feature.

A closure applied by axial rather than rotational motion.

A closure with cooperating ratchet or engagement means between the skirt of the closure and the tamper ring such that co-operation between the said means or any of them on the skirt and the tamper ring tends to prevent rotational force on the tamper ring during application from severing the frangible bridges connecting the tamper ring to the skirt of the closure.

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Various means of employing an additional foil seal to ensure freshness of the contents of a container and which may include a means to pierce the foil.

Utilising a closure with tabs or projections extending inward towards the neck of the container and in one non limiting embodiment, also extending upwards to engage the tamper bead on the container neck but also to be shaped so as the leading edge of at least one tab upon removal rotation engages with an engagement means on the container neck which creates downwards movement of the tamper ring promoting separation of the tamper ring from the closure

Closures made of metal or plastic or metal and plastic combined as may be useful in hot fill vacuum seal packages.  
Containers of plastic, metal and glass.

The present invention also extends in a non limiting manner to any one or more of the foregoing aspects combined.

  
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